

Effects of botanical and synthetic pesticides on arbuscular mycorrhizal fungi

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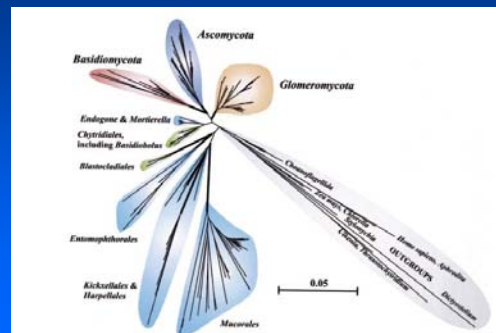
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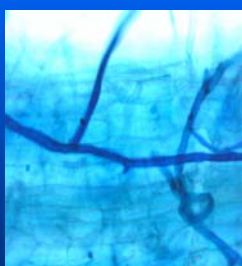


Arbuscular Mycorrhizal Fungi

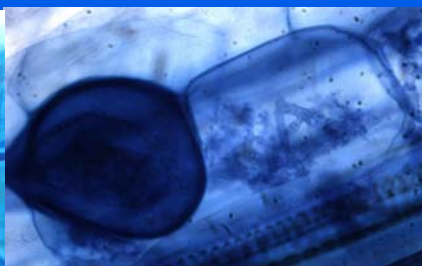
- Fungi of the phylum Glomeromycota



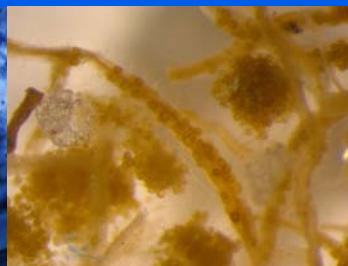
- Obligate symbionts with more than 80% of the known plants being mycorrhizal



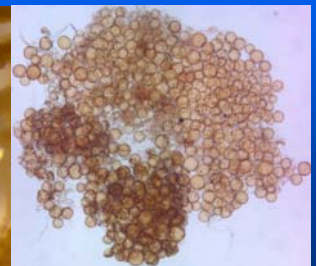
Hyphae



Arbuscules



Spore masses in roots



Spores

What do they offer to the plants?

- Increasing phosphorus absorption
- Increasing absorption of other soil nutrients like N, K, Cu, Zn
- Protection from soil pathogens including fungi and nematodes
- Increasing stress tolerance to high salinity and drought

Facts where our work is based I

- In conventional farming systems with high inputs of fertilizers and pesticides AMF diversity and role is low
- In agricultural systems with limited inputs of fertilizers and pesticides such as organic farming, AMF use is promising for increasing crop production
- Crop protection in organic farming relies mainly on pesticides of biological origin

Facts where our work was based II

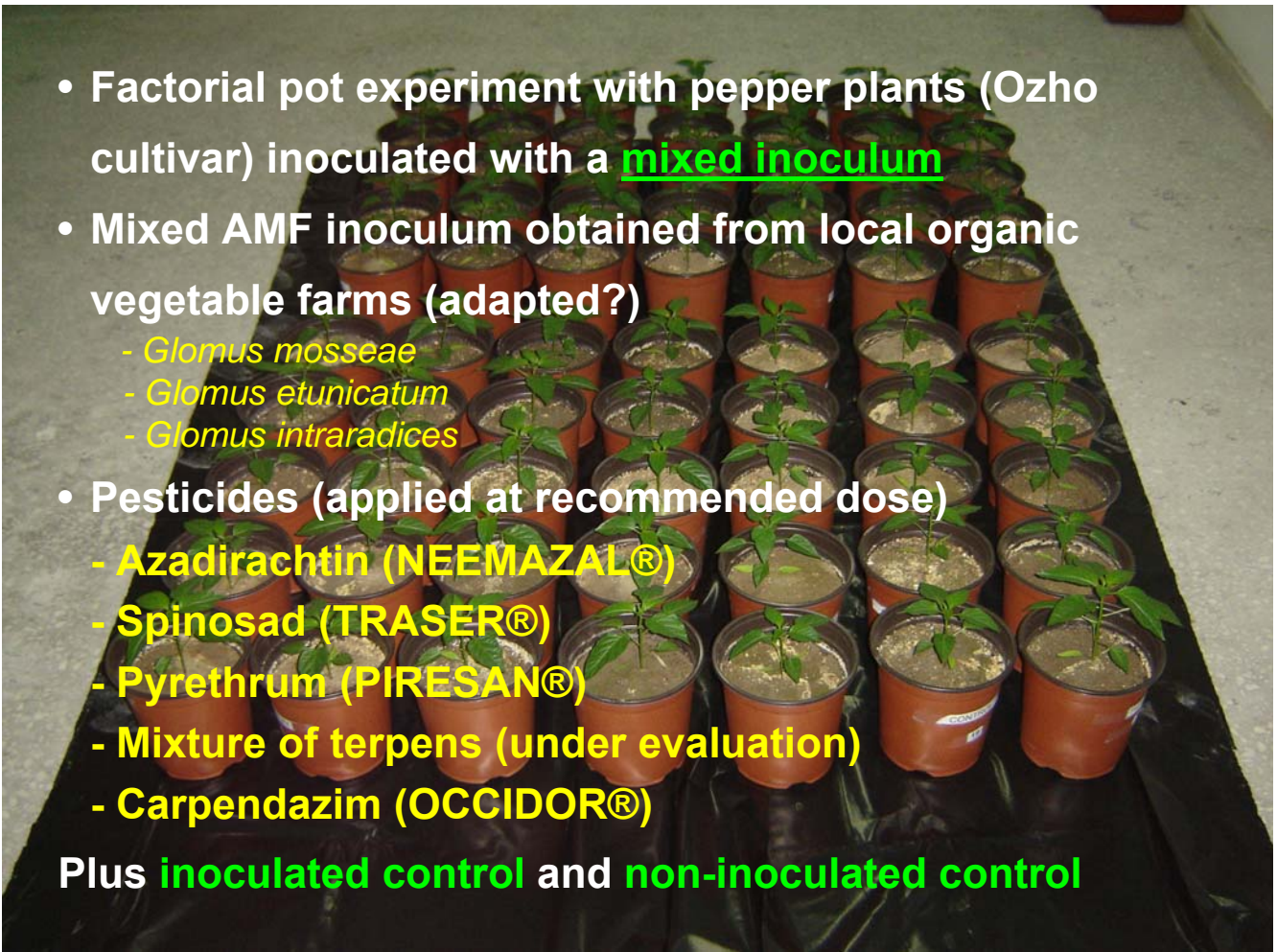
- More than 400 papers on the effects of synthetic pesticides on soil microbial community
- Few of them focus on the **effects of synthetic pesticides on AMF**
- Only one paper!!! has looked at the **effects of pesticides of biological origin (used in organic farming) on AMF**

Aim

- To evaluate possible effects of biological pesticides on AMF community in plant roots

Experimental Procedures

- Factorial pot experiment with pepper plants (Ozho cultivar) inoculated with a mixed inoculum
 - Mixed AMF inoculum obtained from local organic vegetable farms (adapted?)
 - *Glomus mosseae*
 - *Glomus etunicatum*
 - *Glomus intraradices*
 - Pesticides (applied at recommended dose)
 - Azadirachtin (NEEMAZAL®)
 - Spinosad (TRASER®)
 - Pyrethrum (PIRESAN®)
 - Mixture of terpens (under evaluation)
 - Carpendazim (OCCIDOR®)
- Plus inoculated control and non-inoculated control



What did we measure.....

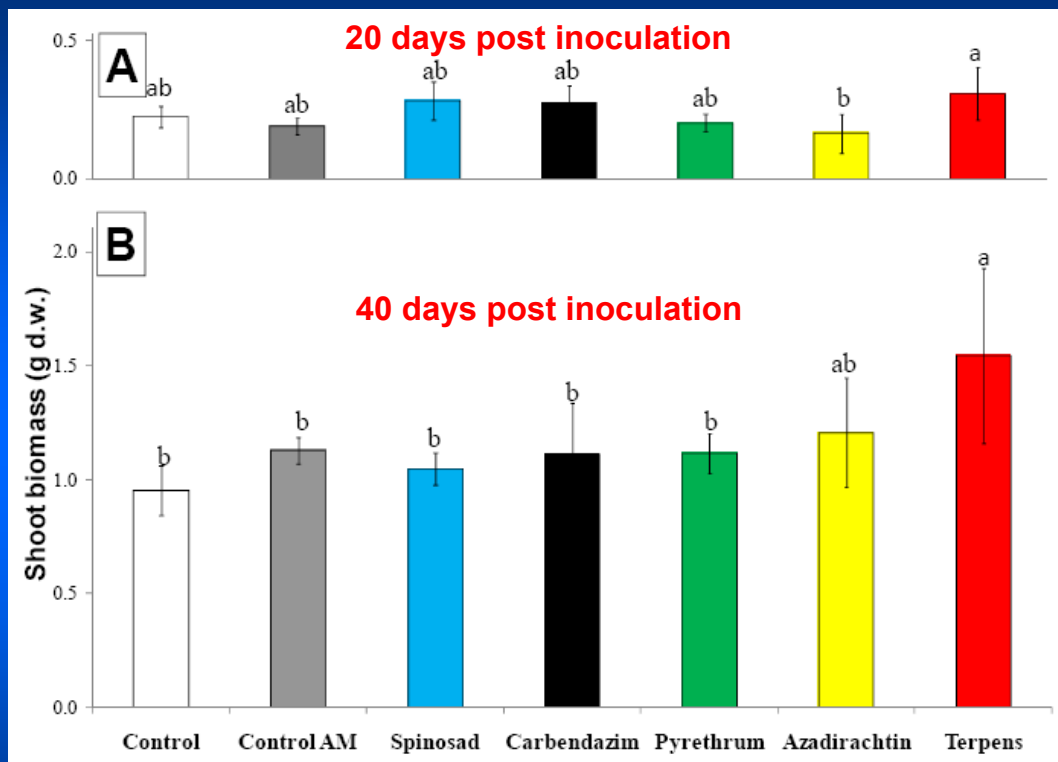
- Two sampling points: 20 and 40 DPI
- Plant Measurements:
 - Plant height
 - Fresh and dry weight of roots
 - Fresh and dry weight of shoots
 - Root length colonization by AMF
- Assessment of AMF community structure:
 - PCR-DGGE in plant roots collected 20 & 40 DPI

Assessment of effects on AMF community

- PCR: AML1 - AML2 (Lee et al., 2008)
- Nested PCR: NS31 + GC - Glo1 (Cornejo et al., 2008)
- DGGE:
 - 8% acrylamide gel
 - Denaturants gradient 38 – 50%
 - Silver staining

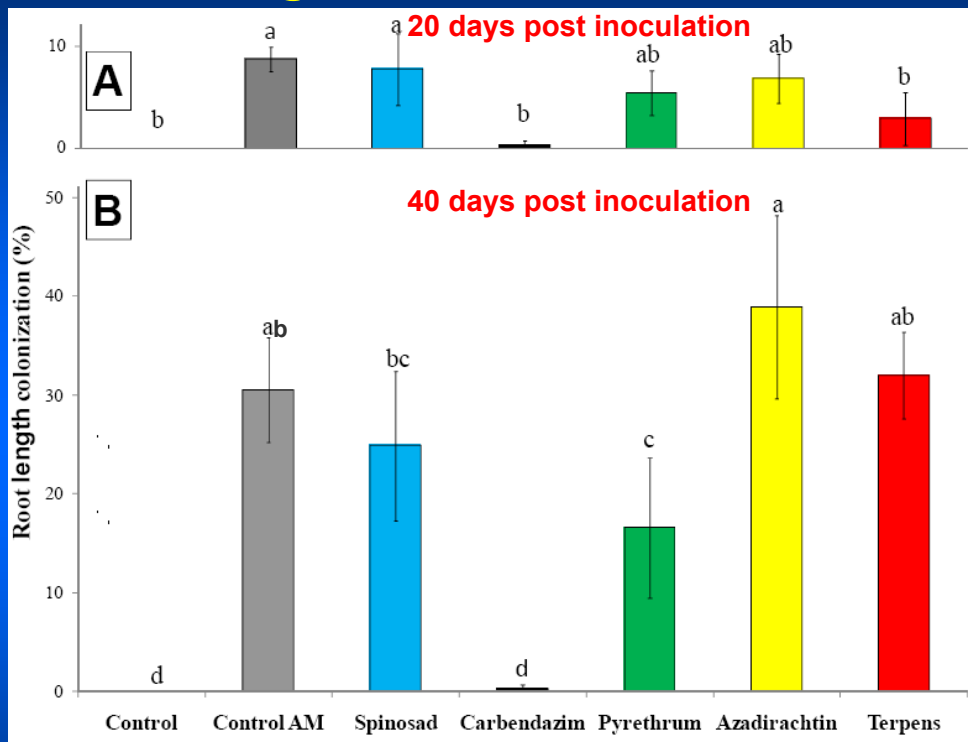
Results

Plant Growth Parameters



- Terpens promoted plant growth at 40 days
- AMF inoculation did not significantly promote plant growth

Root Length Colonization from AMF



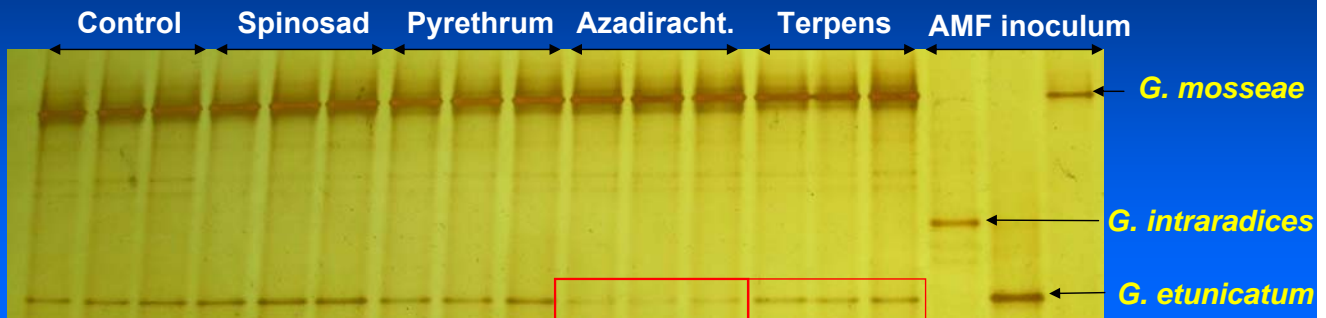
- The fungicide **carbendazim** completely inhibited AMF colonization
- **Pyrethrum** and **spinosad** inhibited AMF colonization
- **Azadirachtin** and **terpens** increased AMF colonization

DGGE – 20 days post inoculation

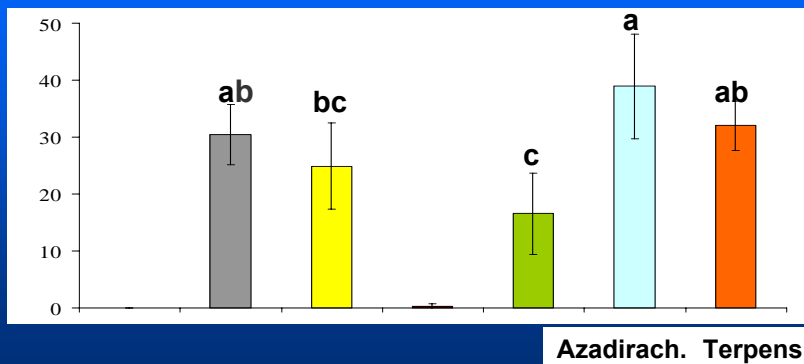


Only *G. mosseae* colonized plant roots regardless of the pesticide applied

DGGE – 40 days post inoculation



Reduced intensity of the *G. etunicatum* band in the plants treated with azadirachtin and terpens



40 days post inoculation
– Root length colonization (%)

Conclusions I

- Both sampling time and pesticides significantly affected quantitatively and qualitatively the community of AM fungi in plant roots
- Azadirachtin and terpens:
 - Appear to have a selective inhibitory effect on one of the AM fungi of the inoculum, *G. etunicatum*
 - Resulted in an increase in root length colonization (only from *G. mosseae*)

This indicates a possible antagonism between AM fungal members of the inoculum

Conclusions II

The changes obtained in the structure of the AMF community in plant roots were not followed by corresponding changes in the function of AMF as shown by the absence of changes in plant growth

Any future plans?

- **On going field study** with the same host plant, the same pesticide treatments, the same AMF inoculum and sampling times at 40 and 90 days post inoculation
- **Measurements:** Plant growth, *Productivity (new)*, *P in plant shoots, roots (new)*, DGGE assessment of effects on AMF community structure (both inoculated and *indigenous community*)

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